

SSVEO IFA List

Date:02/27/2003

STS - 35, OV - 102, Columbia (10)

Time:04:18:PM

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 001:04:44	Problem	FIAR BFCE 029-F022 IFA STS-35-V-01	OI - Recorders
INCO-03	GMT: 337:11:34		SPR IPR	Manager: Engineer:
			UA PR INS-22-11-0669	

Title: Operations Recorder 1 Track 2 Unable to Dump Data (ORB)

Summary: DISCUSSION: Data could not be dumped from the flight operations (OPS) recorder 1 Track 2 from 337:09:23 to 337:09:35 Gmt. Track 2 was not used during the rest of the flight. The recorder was removed at Dryden Flight Research Center and sent to JSC for failure analysis.

CONCLUSION: Functional testing of the OPS-1 recorder revealed bit error rates (BER) in excess of acceptable limits on track 2. Also, time interval analysis of recorded data showed poor alignment of flux reversals within bit cells on track 2. These results are characteristic of recorder head wear failure. It has been concluded that the OPS-1 recorder used on STS-35/OV-102 experienced head failure due to excessive wear. **CORRECTIVE_ACTION:** The defective recorder heads will be replaced. The recorder has been sent to the vendor for repair. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 001:05:30	Problem	FIAR JSC-EE-0661 IFA STS-35-V-02	undefined
INCO-02	GMT: 337:12:20		SPR IPR	Manager: Engineer:
			UA PR COM-2-11-0159	

Title: Text and Graphics System Developer Paper Jams (GFE)

Summary: DISCUSSION: STS-35 was the first mission in which the text and graphics system (TAGS) hardcopier was powered off when not in use (to conserve electrical power) and powered on only long enough to receive data once every 12 hours. At about 336:15:22 G.m.t., and again at about 337:12:20 G.m.t., at the start of two of the first four receiving sessions, the TAGS hardcopier experienced developer paper jams. Both of these jams were cleared by the crew, using the TAGS in-flight maintenance

(IFM) tool.

In each of the two instances when a jam occurred, transmission of data from the ground controllers was initiated per established procedures immediately upon receipt of a "NORM TEMP" telemetry indications (approximately 15 minutes after power on). In the two instances where jams did not occur, transmission of data was not begun immediately, but was delayed for at least 1 hour. Because of the apparent correlation of paper jams with limited warm-up time, procedures were modified to allow the hardcopier to warm up from a cold start for at least 45 minutes prior to any data reception. This procedure appeared to have solved the problem and no more jams occurred until the seventh data receiving session of the mission. The final jam occurred at about 339:13:14 G.m.t., as the third page of that message sequence was passing through the developer. During the attempt to clear the jam, the TAGS IFM tool broke and could not be repaired. The TAGS hardcopier was powered off for the remainder of the mission and the Teleprinter was used for reception of all subsequent uplink messages. The postflight anomaly investigation revealed two separate and unrelated problems. A visual examination of the STS-35 hardcopier developer and the still undisturbed paper jam clearly showed that the final jam was caused by a portion of the leading edge of the paper becoming caught in the gap between the developer drum and the center deflector. The deflector is designed to separate the page from the drum and to guide it through the developer exit slot. The gap was measured and found to be two and one-half times larger than the specified setting on the left side, where the page was caught. The excessive gap resulted from improper alignment of the deflector with the drum. The gap was just large enough to permit an occasional jam. The developer unit was new and had been installed in the hardcopier after its previous flight (STS-34) as a replacement for one that was found to have an electrical defect. The deflector gap had been set by the manufacturer and the entire developer assembly had been acceptance tested prior to delivery as a spare. In the absence of any anomalous indications, the deflector gap was not reset or checked upon installation in the hardcopier. This type of paper jam is, in general, not clearable with the TAGS IFM tool. Since the crew was able to readily clear the first two jams and to observe in each case that the leading edge had completely exited the developer, the misaligned deflector could not have been the cause of the first two jams. Extensive postflight thermal analysis and testing confirmed the hypothesis that the first two paper jams were caused by moisture condensation on the deflector surfaces inside the developer, and that the condensation was caused by insufficient 0-g warm-up time for the deflectors. When operating in 1-g, the deflectors heat up very rapidly because of their close proximity to the heater drum, and reach a temperature that is sufficient to prevent condensation at about the same time that the heater drum becomes hot enough to boil water vapor out of the paper. Therefore, in 1-g, there is never a problem with condensation on the deflector surfaces. However, when operating in 0-g, without the benefit of convective heat transfer, the deflectors heat up much more slowly and do not reach a temperature that is sufficient to prevent condensation until about 30 minutes after the heater drum has reached its normal operating temperature. If paper is processed through the developer during this period of time, a paper jam is likely to occur at the developer exit after two or three pages, because of wet deflector surfaces. Design changes to improve the 0-g thermal profile of the deflectors are under investigation. However, until one is identified and implemented, a 0-g warm-up time of 45 minutes, from a cold start, will be required for the TAGS hardcopier. **CONCLUSION:** The first two paper jams were caused by moisture condensation inside the developer, and that moisture was the result of insufficient warm-up time in 0-g. The third paper jam was caused by an improperly positioned paper deflector inside the developer. **CORRECTIVE_ACTION:** The TAGS hardcopier, Part No. AV14453-303, Serial No. 003, was removed, replaced, subjected to failure analysis, and repaired. Procedures will be changed to require a 45-minute, minimum, warm-up period from a cold start, prior to in-flight usage of the TAGS hardcopier. The improperly positioned paper deflector was repositioned to achieve proper developer drum clearance. Proper clearance will be verified by direct measurement in all new developers prior to installation in hardcopiers. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 003:06:39	Problem	FIAR BFCE 213-F006 IFA STS-35-V-03	TAGS
MMACS-06	GMT: 339:13:29		SPR UA	Manager:
			IPR None PR	Engineer:

Title: TAGS Unjamming Tool Broke (GFE) (GFE)

Summary: DISCUSSION: During efforts to clear the second TAGS jam, which occurred at 337:12:21 G.m.t., the end assembly of the TAGS unjamming tool came loose, rendering the joint connecting the end assembly to the shaft of the tool had broken. The crew attempted to repair the tool to no avail. The tool was stowed and no further TAGS operations were attempted for the remainder of the mission.

Postflight inspection revealed that the end assembly was soldered with a negligible amount of silver solder causing the joint to be highly susceptible to breakage. Four other TAGS tools in the inventory were found to have similarly small amounts of solder in them and none of the tools in inventory had more than one-half the required amount of solder. CONCLUSION: The STS-35 TAGS unjamming tools broke because an inadequate amount of silver solder was used to secure the end assembly of the tool to the shaft. CORRECTIVE_ACTION: Two TAGS unjamming tools have been identified in the inventory which have approximately one-half the required amount of solder. This amount of solder will allow approximately 150 pounds of shear force to be applied through the tool. This amount of force has been deemed adequate for normal TAGS unjamming operations. Both of these tools have been manifested for the STS-39 mission per CCB directive G2606. For the long term, five new tools have been received from a different distributor and are being X-rayed to check for proper soldering. These will be manifested on future missions. The five old tools with minimal solder will be scrapped and the two STS-39 tools will be relegated to ground use after the new tools become operational.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 001:15:49	Problem	FIAR IFA STS-35-V-04	OMS/RCS
PROP-01	GMT: 337:22:39		SPR 35RF02 UA	Manager:
			IPR 40V-0011 PR	Engineer:

Title: Left RCS Drain Panel Heater A Not at Normal Temperature (ORB)

Summary: DISCUSSION: After exhibiting one nominal cycle, the left reaction control subsystem (RCS) drain panel system A heater failed-off. After the panel temperature dropped to 52° F, 3° F above the fault-detection-annunciator limit, the left orbital maneuvering subsystems (OMS) pod system B heaters were enabled and the

left RCS drain panel system B heater performed nominally. However, to conserve power on this long-duration mission, the system A heaters were re-enabled and used for the majority of the remainder of the mission. The FDA limit of the panel monitoring sensors was changed by a ground update to 34° F to avoid alarms, but still protect the hardware. The panel temperature remained above 47° F, although the system A heater never again cycled.

CONCLUSION: Troubleshooting revealed that the cause of the heater failure was a failed-open thermostat. **CORRECTIVE_ACTION:** The thermostat has been removed and replaced. A CAR has been opened to investigate the cause of the failure. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None. A redundant heater is available and attitude thermal control can be utilized, if both heaters fail.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET: 003:05:40	Problem	FIAR	IFA STS-35-V-05	Water and Waste
EECOM-01	GMT: 339:12:30		SPR 35RF03	UA	Management System
			IPR	PR ECL-0595	Manager:
					Engineer:

Title: Waste Water Dump Degradation (ORB)

Summary: **DISCUSSION:** During the STS-35 flight, the waste-water dump rate gradually declined from 1.73-percent/minute during the first dump to 0.26-percent/minute during the fourth dump. At the lower rate, the dump was stopped to prevent icing of the dump nozzle. The waste water was subsequently off-loaded into the contingency waste container (CWC), the contingency urine collection devices (UCDs) and the contingency female urine absorption system (UAS) bags. The crew reported that "metallic-looking" debris was visible in the hose during the transfer to the UAS bags. The crew subsequently attempted to purge the dump line by connecting the inflight maintenance hose to the Orbiter's pressure control system 30-psi nitrogen source and then to the contingency water cross-tie waste quick disconnect (QD). This procedure was unsuccessful.

CONCLUSION: Postflight inspections revealed that the high capacity urine solids filter had come apart, and this filter was the source of the debris observed by the crew. Debris from this same filter also clogged the waste water dump line. It has been determined there is an age life issue with these filters. **CORRECTIVE_ACTION:** The dump nozzle, the dump valve, and the QDs were removed and replaced. The lines were flushed and verified clean by sampling. A new high-capacity urine solids filter was also installed. The urine solids filters for OV-103, OV-104, and OV-105 were removed and replaced with filters that were verified to contain good filter material. The lines for OV-103 were also flushed and verified to be free of particles. These filters will be changed out in the future on a time interval basis to prevent degradation. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 000:11:10	Problem	FIAR BFCE-029-F024; IFA STS-35-V-06	GFE
INCO-10	GMT: 336:18:00		BFCE-029-F025; BFCE- UA	Manager:
			029-F026; BFCE- PR	
			SPR	Engineer:
			IPR None	

Title: Inoperative Headsets and Crew Remote Unit (GFE)

Summary: DISCUSSION: During STS-35, the crew experienced intermittent transmissions with three headsets and reported that another headset was physically broken. Also, one crew remote unit (CRU) would not transmit. The four headsets as well as the one CRU were returned to JSC for troubleshooting.

CONCLUSION: Troubleshooting of the physically broken headset showed that the sleeve that holds the wire cable together on the headset was missing epoxy. This condition left the wire without any support to hold it in place. The postflight evaluation revealed that the other three headsets had the microphones installed backwards. This misconfiguration resulted in the headset microphones not being as sensitive as usual, and this reduced the signal level. Postlanding tests isolated the CRU failure to the transmit synthesizer. The synthesizer was replaced and the unit was functioning properly. **CORRECTIVE_ACTION:** The physically broken headset was removed from inventory and the microphones were reinstalled properly in the other headsets. All headsets for the next flight for each vehicle as well as the inventory stock were inspected to insure that the microphones were correctly installed and also that the headsets were properly epoxied. Those not meeting specifications will be repaired. The synthesizer in the CRU was sent to the vendor for further troubleshooting. The CRU's for the next flight have been tested and are functional.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None. One headset per crewman with two spare headsets are flown. Each crewman has a CRU and one spare CRU is always flown. There are several other means of communications available, such as handheld microphones and the launch/entry suit communications carrier assembly (a hardline which may be used to back-up the wireless communications system) should these failures recur.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR BFCE-029-F029; IFA STS-35-V-07	CCTV
INCO-07, INCO-08	GMT: 340:13:23		BFCE-029-F030; BFCE- UA	Manager:
			029-F031 PR	
			SPR	Engineer:
			IPR None.	

Title: Closed Circuit Television (GFE) Problems: a) Camera B Failed b) Camera C Color Wheel Sticking c) Camera D Intermittent Power Up/Commanding (GFE)

Summary: DISCUSSION: a) At approximately 340:13:23 G.m.t., the crew reported that no picture could be obtained from closed circuit television (CCTV) camera B.

Further commanding from the ground indicated the same result. After the flight, the camera was removed and sent to the flight equipment processing contractor (FEPC) for troubleshooting. FEPC confirmed that the failure was in the camera unit and that the lens assembly functioned correctly.

b) When camera C was activated at 341:22:06 G.m.t., the image showed a convex black area at the top, concave black area on the bottom, and a black-and-white picture in the center. Cycling the camera power did not clear the problem. A previous occurrence of this problem at 339:13:27 G.m.t., did clear with a power cycle. The camera was repowered at approximately 342:14:40 G.m.t., and operated nominally. This behavior was typical of the color wheel sticking within the lens assembly. After the flight, the camera was removed and sent to FEPC for troubleshooting. FEPC could not reproduce the failure. c) Early in the mission, power was applied to CCTV camera D and no image appeared on the monitor. Later in the mission, power was again applied to camera D and an image was obtained on the monitor. The downlink video appeared to show that the camera had experienced phase shifts of varying degrees and that the failure to power up properly was thought to be the result of a large phase shift. After the flight, the camera was removed and sent to FEPC for troubleshooting, which revealed that the camera was not phase shifting. Power to the camera was cycled more than 10 times and the failure to power up properly could not be reproduced. A delamination was discovered in the silicon intensifier tube (SIT) in the lens assembly caused the image to have a green tint that was initially interpreted as phase shifting. This was the second flight in a row where intermittent power-up problems were experienced with camera D, and no hardware failures were discernible after the flight. The procedures, circuit breaker and switch nomenclature, and crew training for activating camera D were reviewed to determine if any changes were made recently or if any procedural "traps" existed that could result in intermittent camera D switch misconfiguration. No such changes or "traps" were found in the review. CONCLUSION: a) Troubleshooting at FEPC has isolated the problem to either a failure in the camera high-voltage power supply or its SIT. Failure analysis by the vendor will pinpoint the exact cause. b) Troubleshooting could not reproduce the problem. The apparent sticking condition of the color wheel was therefore transient and was most likely caused by the extremely cold environment experienced on the STS-35 mission. c) Troubleshooting could not reproduce the problem. The review of camera D operations could not determine any operational problems that could have caused this anomaly. A delamination in the SIT was discovered during troubleshooting; however, delamination was not considered to be a contributor to the failure of camera D to power-up properly.

CORRECTIVE_ACTION: a) Camera B has been removed and replaced. The replaced camera will be verified per the OMRSD retest requirements. The removed camera (S/N 042) has been sent to the vendor for failure analysis and repair. Crew safety will not be impacted if this problem recurs, and redundant CCTV cameras can be used to insure mission success. b) Camera C has been removed and replaced. The replaced camera will be verified per the OMRSD retest requirements. The removed camera (S/N 017) will be returned to the inventory. If this problem recurs, the camera is still functional, and the problem may clear with a power cycle, time, or maneuvering to a warmer attitude. c) Camera D has been removed and replaced. The replaced camera will be verified per the OMRSD retest requirements. The removed camera (S/N 028) will be returned to the vendor for further troubleshooting and replacement of the SIT. The lens assembly for the removed camera (WLA 004) will be returned to the inventory. Crew safety will not be impacted if this problem recurs, and redundant CCTV cameras can be used to insure mission success.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>		<u>Subsystem</u>
MER - 0	MET: 004:01:11	Problem	FIAR	BFCE 029-F028	IFA STS-35-V-08
INCO-05	GMT: 340:08:01		SPR		UA
			IPR		PR INS-2-11-0670
					Manager:
					Engineer:

Title: Flight Operations Recorder 2 Track 5 Degraded Data Quality. (ORB)

Summary: DISCUSSION: At 340:08:01 G.m.t., the dump of track 5 flight operations (OPS) recorder 2 showed degraded quality data when dumped in both directions. The recorder was removed at Dryden Flight Research Center and sent to JSC for failure analysis.

CONCLUSION: Functional testing of the OPS-2 recorder revealed bit error rates (BER) in excess of acceptable limits on track 5. Also, time interval analysis of recorded data showed poor alignment of flux reversals within bit cells on track 5. These results are characteristic of recorder head wear failure. It has been concluded that the OPS-2 recorder used on STS-35/OV-102 experienced head failure due to excessive wear. **CORRECTIVE_ACTION:** The defective recorder heads will be replaced. The recorder has been sent to the vendor for repair. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>		<u>Subsystem</u>
MER - 0	MET: 003:12:28	Problem	FIAR	BFCE 029-F027	IFA STS-35-V-09
INCO-06	GMT: 339:19:18		SPR		UA
			IPR		PR INS-2-11-0671
					Manager:
					Engineer:

Title: Payload Recorder Track 5 Experienced Degraded Quality. (ORB)

Summary: DISCUSSION: At 392:12:18 G.m.t., during a payload recorder dump of high rate management (HRM) format 6 (4 to 1) data, the MSFC Payload Operations Center (POCC) reported degraded quality data. Attempts to redump the data were not successful. At 340:06:45 G.m.t., during a format 16 (2 to 1) dump, MSFC again reported degraded quality data. Format 9 (1 to 1) dumps were not affected. Further degradation occurred in the payload recorder at 342:05:00 G.m.t. Payload recorder dumps in HRM formats experienced frequent data dropouts. However, the same data brought down simultaneously via KU band channel 2 direct did not have these dropouts. Additionally, format 9 which was previously operational, was now experiencing occasional dropouts on track 5. The HRM passed self-test. Recorder dumps for the rest of the mission were accomplished in format 9 via Ku-Band or FM. The recorder was removed at Dryden Flight Research Center and sent to JSC for failure analysis.

CONCLUSION: Functional testing of the payload recorder, that consisted of recording and playback using the 1 to 1, 2 to 1, and 4 to 1 formats with various data rates, revealed that bit error rates (BER) were within acceptable limits on all tracks. Also, time interval analysis of recorded data exhibited nominal alignment of flux reversals within bit cells on all tracks. These results indicate normal recorder performance. The problem/condition experienced with the payload recorder used on STS-35/OV-102 could not be reproduced during laboratory testing of the recorder. JSC and MSFC are conducting further analysis of the HRM system. CORRECTIVE_ACTION: No further action required on this recorder. Recorder will be returned to flight status. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 000:02:01	Problem	FIAR	IFA STS-35-V-10
GNC-01	GMT: 336:08:51		SPR 35RF04	UA
			IPR 40V-0012	PR
				Manager:
				Engineer:

Title: The -Z Star Tracker Failed Self-Test. (ORB)

Summary: DISCUSSION: The -Z star tracker (serial no. 006) failed the first two self-test attempts after initial power up. The failure occurred in the "Reduced Field of View" phase of the test and resulted from an apparent self-test-star position error. Subsequent self tests were successful, and the star tracker performed normally for the remainder of the mission. This is the first in-flight occurrence of a star tracker self-test failure.

Troubleshooting at KSC consisted of performing 58 test sequences that exercised various self-test modes. During these tests, four failures in position-only resulted and sixteen failures in position and magnitude occurred. Analysis of the test and flight data by the vendor indicates that this anomaly is the result of deficiency in the circuit that provides the "staircase threshold" signal. This deficiency can result in premature comparison of the self-test position and/or magnitude data to the expected values. This anomaly is a random occurrence and will not mask a true failure of the unit. The deficient circuit is used only within the self-test function and has no effect on the ability of the star tracker to acquire and track a star. CONCLUSION: This anomaly was the result of a deficiency in the star tracker self-test circuitry. It is temperature related and is generic to all units, however, some trackers may exhibit the symptom more than others. CORRECTIVE_ACTION: None. Fly-as-is. EFFECTS_ON_SUBSEQUENT_MISSIONS: No effect on star tracker performance. The possibility exists that an anomalous "ST FAIL" message will occur during self-test, in which case the self-test should be repeated.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 006:21:30	Problem	FIAR	IFA STS-35-V-11
MMACS-05	GMT: 343:04:20		SPR 35RF05, 35RF10	UA
			IPR	PR APU-2-10-0194
				Manager:
				Engineer:

Title: APU Gas Generator Bed Temperature Slow Response. (ORB)

Summary: DISCUSSION: During the flight control systems checkout and entry, the gas generator bed temperature measurement (V46T0222A) exhibited a slow response to the temperature increase associated with starting an auxiliary power unit (APU). This measurement required approximately 50 seconds to reach 500 degrees Fahrenheit (off-scale high limit) compared to the nominal time of 12-14 seconds. This measurement reacted nominally during the ascent start-up and during heater cycling operations on-orbit throughout the mission. The STS-32 data shows that the gas generator bed temperature response was slow on this mission during start-up for entry as well. It should be noted that the injector tube temperature measurement (V46T0274A), which closely tracks the gas generator bed temperature, reacted nominally during the start-ups, but was indicating approximately 46 degrees Fahrenheit higher than the gas generator bed temperature during all phases of on-orbit heater cycling. This biased temperature reading was experienced on this APU S/N 308 during STS-32 as documented in inflight anomaly (IFA) report STS-32-3D. It is not known if the temperature bias between the gas generator bed and injector tube sensors is related to the slow gas generator bed temperature response, but the two problems are most likely due to the same cause.

APU 2, S/N 308, was removed and returned to the manufacturers because of excessive hydrazine exposure to the gas generator valve module (GGVM) shutoff valve seat (Chit J3476). The gas generator will be removed from the APU and returned to its manufacturer for failure analysis of the two temperature sensors and also for fleet leader studies of the chromized injector stem. The APU will be converted to an improved APU before returning to the fleet. Analysis of flight data could not determine the exact cause of the gas generator bed temperature slow response. The analysis indicates that the anomalous condition can most likely be attributed to the gas generator bed temperature sensor becoming detached from the wall of the injector well. When this condition exists, the heat transfer rate between the injector wall and sensor is decreased and this results in the slow response to the temperature. During on-orbit heater cycling, the heat transfer is more uniform and this allows the two sensors to track more closely. The biased results between the two measurements, as seen during heater cycling, are believed to be caused by detachment of one or both sensors. The gas generator bed temperature sensor is used to control and verify the gas generator bed heater operation via input to the comparator circuit in the APU controller. Failure of the gas generator bed temperature sensor is protected for the failed-off condition only by the gas generator plate thermostat. Corrective Action Record (CAR) 35RF05-010 was written against the gas generator bed temperature slow response and was closed as a repeat problem and transferred to CAR 32RF10-010. CAR 32RF10-010 was written against the bias conditions between the gas generator bed and injector tube temperatures and was closed as an "Explained short CAR close-out, all vehicles, all flights." CAR 35RF05-010 should not have been transferred to CAR 32RF10-010 because of the different failure scenarios. The STS-35 CAR will be re-opened and addressed as a separate problem. CONCLUSION: The analysis indicates that the anomalous condition can most likely be attributed to the gas generator bed temperature sensor becoming detached from the wall of the injector well. This hypothesis will be verified when the gas generator is returned to the vendor for failure analysis. CORRECTIVE_ACTION: The gas generator will be removed from the APU and returned to its manufacturer for failure analysis. The APU will be converted to an improved APU before returning to the fleet. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>		<u>Documentation</u>	<u>Subsystem</u>
MER - 1	MET:	Problem	FIAR	IFA STS-35-V-12	
	GMT:		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Deleted ()

Summary: This problem was incorporated in Problem STS-35-V-07, item b.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>		<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 005:18:40	Problem	FIAR	IFA STS-35-V-13	C&T - S-Band
INCO-09	GMT: 342:01:30		SPR 35RF06	UA	Manager:
			IPR 40V-0013	PR	
					Engineer:

Title: Upper Left S-Band Antenna Performance Poor (ORB)

Summary: DISCUSSION: Many unexplained forward link dropouts occurred throughout the mission when using the upper left (UL) S-band antenna. Over the duration of a Tracking and Data Relay Satellite (TDRS) pass, these dropouts were characterized by coincident slow variations in reflected power (beginning at 4 or 5 watts, dropping to 1 or 2 watts and then returning to 4 or 5 watts).

CONCLUSION: Postflight inspection and troubleshooting at KSC revealed a loose connection in a pair of RF coaxial cables to the UL antenna. Upon demating and inspection, the cable connectors showed evidence of burn damage from overheating (the overheating was probably a result of a loose cable connection). This condition is the most probable cause of the inflight anomaly. Additional tests after cable replacement showed that the UL antenna was still subject to some brief dropouts, which indicated a potential antenna problem. **CORRECTIVE_ACTION:** The two coaxial cables (W523 and W561) plus the UL antenna and its adjacent coaxial cable (W522) were removed and replaced with spares. The removed hardware was returned to the vendor for failure analysis and testing. All troubleshooting and retest procedures are complete and the normal turnaround tests for the S-band system have been successfully completed. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>		<u>Documentation</u>	<u>Subsystem</u>
MER - 2	MET:	Problem	FIAR	IFA STS-35-V-14	
	GMT:		SPR	UA	Manager:

IPR

PR

Engineer:

Title: Deleted ()

Summary: This problem was incorporated in Problem STS-35-V-07, item c.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET:	Problem	FIAR	IFA STS-35-V-15	C&T
INCO-11	GMT:		SPR None	UA	Manager:
			IPR 40V-0015	PR	

Engineer:

Title: Noise on Air-to-Ground Channel 2 (ORB)

Summary: DISCUSSION: Several times during STS-35, a white-noise hiss was heard on the air-to-ground (A/G) channel 2 communications loop. The noise was intermittent, but usually occurred just after a crewmember spoke. The crew did not hear this problem. This anomaly also occurred on STS-28 and during KSC testing of OV-102.

CONCLUSION: Postlanding tests have duplicated this anomaly. Troubleshooting has isolated the noise to either a network signal processor (NSP) delta modulator problem or to an audio central control unit (ACCU) problem. CORRECTIVE_ACTION: The ACCU (ser. no. 0002) that is currently installed on OV-102 is being removed because of a situation unrelated to the A/G 2 noise. Although the ser. no. 0002 removal is unrelated, the A/G 2 anomaly may be corrected by this removal and replacement. Regarding the NSP as a possible cause, the NSP delta modulator normally experiences noise and this noise is acceptable.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Should A/G channel 2 fail, A/G channel 1 is available. A/G ultrahigh frequency (UHF) is also available for voice-only communications over UHF-supported ground sites.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-35-V-16	TPS
None	GMT: Postlanding		SPR 35RF08	UA	Manager:
			IPR	PR STR-2-11-2705	

Engineer:

Title: A 24" piece of the environmental seal between panels 1 and 2 on the right payload bay door (PLBD) was found loose on top of the PLBD. (ORB)

Summary: DISCUSSION: The PLBD environmental seal that is located in the expansion joint between door segments 1 and 2 became debonded approximately 2 feet and was protruding from under the PLBD belly band. The postflight inspection performed at KSC revealed that one side of an electrical ground metal sheet had become dislodged and encroached into the environmental seal volume, causing the seal to debond.

CONCLUSION: The environmental seal hardware is not discrepant. CORRECTIVE_ACTION: The ground strap that interfered with the seal was removed. The ground strap was not replaced because a redundant strap already exists. A new three-foot section of seal was installed to replace debonded seal.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET:	Problem	FIAR	IFA STS-35-V-17	HYD
None	GMT:		SPR 35RF09	UA	Manager:
			IPR None	PR	
					Engineer:

Title: Water Spray Boiler 3A Cooling Abnormal (ORB)

Summary: DISCUSSION: The water spray boiler (WSB) 3A cooling of auxiliary power unit (APU) 3 lubrication (lube) oil was abnormal during ascent and entry. During ascent, WSB 3 did not initiate spray cooling until the lube oil return temperature reached approximately 277° F (about 12 minutes after liftoff). Spray cooling should have started at a lube oil temperature of approximately 250° F (about 11 minutes after lift-off). During entry, momentary overcoolings of the lube oil were observed prior to reaching hydraulic heat exchanger mode. The lowest momentary excursion was to 235° F, while maintaining a 250° F temperature is normal.

These problems were most likely caused by wax in the lube oil that resulted from hydrazine leaking into the gearbox and mixing with the lube oil to form hydrazide wax. This same system showed evidence of wax on the prior flight of OV-102 when the APU 3 lube oil gearbox pressure was high after APU start-up (IFA STS-32-02). During ground operations prior to STS-35, the lube oil system was drained and flushed at room temperature, the lube oil filter was changed, and APU 3 was removed and replaced. However, the WSB 3 lube oil system probably still contained a substantial quantity of wax. The probable cause of the STS-35 ascent undercooling problem was spray bar freeze-up. This condition resulted from lube oil wax contamination within the lube oil system including the WSB tube bundle which altered the head transfer characteristics of the system. The tube bundle in the WSB core consists of two passes of 0.1-inch inner-diameter tubes. The 103 first-pass tubes are crimped to a 0.06-inch inner diameter and 81 second-pass tubes are not crimped. Because of the small diameter of the tubing, the wax restricted the flow through the WSB tube bundle and altered the heat transfer of the WSB. This resulted in less heat being radiated to the spray bar from thawing and more residual core water remaining after MECO. At SSME cutoff, the residual water in the WSB froze the spray bar because of the near vacuum atmosphere in the WSB core and the lack of g-loads maintaining the water in a pool.

One minute later the radiant heat of the system was able to thaw the frozen spray bar and allow spraying to begin. The momentary overcooling by WSB 3A during entry probably resulted from plugged tubes and associated heat transfer changes caused by wax in the system. This resulted in increased lube oil cooling for a given water spray rate, which is a function of the temperature delta above the 250° F set point. There is no core water during entry, so spray bar freezing was not a factor. Per normal operations, the WSB 3B system was not used for lube oil cooling during the mission. The problem experienced during ascent had the characteristics of spray bar freezing, so the 3A controller was not suspected of being faulty. **CONCLUSION:** WSB 3A lube oil cooling abnormalities were observed during ascent and entry and most probably resulted from the presence of excessive amounts of hydrazide wax within the lube oil. Because of the wax, a spray bar freeze-up resulted and caused a temporary undercooling of the lube oil following MECO. A change in the heat transfer characteristics of the lube oil system also caused overcooling during entry. **CORRECTIVE_ACTION:** A hot oil flush (closed loop) was performed on the APU/WSB 3 system following the flight to remove the excess wax. Reference Chit J-3511. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>		<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-35-V-18	STR
None	GMT: Postlanding		SPR 35RF10	UA	Manager:
			IPR	PR STR-2-11-2703	
					Engineer:

Title: Chip on Orbiter Window Number 1. (ORB)

Summary: DISCUSSION: During the postflight inspection at Edward Air Force Base, an impact crater (pit) with "spider-webbing" type cracks emanating from the impact point was discovered at the upper-right hand corner of the left-hand outer window thermal pane (Orbiter window number 1). The crew observed the pit midway through the mission. When the vehicle was returned to the Kennedy Space Center (KSC), the pit was measured using a mold impression and a microscope. The pit dimensions were a maximum diameter of 0.15-inch and a maximum depth of 0.005", and the cracked area was approximately 1.0-inch in diameter around the pit. All of these dimensions exceeded the allowable specification. An analysis evaluated the window's residual strength and life and indicated that the window should be replaced. The window was removed and replaced and the pitted window was returned to the Johnson Space Center (JSC) for further evaluation (reference Internal Letter 280-SSD-107-91-015 dated February 15, 1991).

Window damage is a natural occurrence during atmospheric and orbital operations. Pits similar to the one discussed in this report have been observed after previous flights (reference CAR 07F015-010 and IM's 08F022-000, 09F033-000, 19F008-000, 30RF24-000 and AD1897-000). Since this is a recurrent problem, the Orbiter windows are inspected for damage after each flight of each vehicle and thermal panes are replaced as required. Limited spares are available. A test program to further the understanding of this damage is under way at JSC. **CONCLUSION:** The window damage is typical of that noted on previous flights. **CORRECTIVE_ACTION:** Remove and replace the window. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR	IFA STS-35-V-19
None	GMT:		SPR 35RF11	UA
			IPR	PR APU-2-11-0217
				Manager:
				Engineer:

Title: APU 2 Lubrication Oil Outlet Pressure High (ORB)

Summary: DISCUSSION: Auxiliary power unit (APU) 2 lubrication (lube) oil outlet pressure (V46P0253A) rose to a higher-than-normal value during ascent, flight control system (FCS) check-out, and entry. Immediately upon start-up each time, the lube oil outlet pressure increased to 90-100 psia and remained in that range for approximately 16 minutes during ascent, 3 minutes during FCS check-out, and 3 minutes during entry before returning to the nominal range of 40-50 psia. This condition was the result of hydrazine leaking into the gearbox during preflight operations, mixing with the lube oil and forming hydrazide wax. During APU operation, the wax accumulated on the lube oil filter causing the high pressure until the lube oil temperature reached approximately 200°F, at which time the wax melted and the pressure returned to normal. This phenomenon has been observed on other Shuttle flights, the most recent being STS-32 (IFA STS-32-02) and STS-33 (IFA STS-33-01).

There would be no effect on APU performance if the oil filter were to become completely blocked. As demonstrated on STS-4 (IFA STS-04-05), a bypass valve bypasses oil around the filter at a lube oil outlet pressure of about 100 psia (50-60 psid). Nominal filter pressure differential is about 5 psid at normal flow rates. **CONCLUSION:** The rise in the APU 2 lube oil outlet pressure after APU 2 start-up was caused by the partial blockage of the lube oil filter with hydrazide wax. The wax was formed because of the preflight leakage of hydrazine into the gearbox. As the lube oil temperature increased during APU operation, the wax blocking the filter melted, allowing the lube oil outlet pressure to return to normal. **CORRECTIVE_ACTION:** APU 2 was removed and replaced due to normal life-cycle constraints. Additionally, a hot lube oil flush was performed on the APU 2 gearbox/water spray boiler system before APU 2 removal. This was completed so that the effectiveness of the procedure could be tested by having APU 2 inspected for wax quantity at the vendor. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 003:12:13	Problem	FIAR	IFA STS-35-V-20
PROP-02	GMT: 339:19:03		SPR 35RF12	UA
			IPR None	PR
				Manager:
				Engineer:

Title: RCS Vernier Thruster R5D Failed Off (ORB)

Summary: DISCUSSION: During STS-35, reaction control subsystem (RCS) vernier thruster R5D was deselected by redundancy management (RM) because of low

chamber pressure indications. The RCS was being fed by left orbital maneuvering subsystems (OMS) interconnect during this failure. The low chamber pressure traces were attributed to gaseous helium ingestion (GHe) by the vernier thruster. After the failure, vernier thruster R5D was reselected and fired five times to clear the GHe. The fifth firing indicated a nominal chamber pressure trace. However, later in the mission, GHe ingestion was observed on vernier thruster R5R. Also, prior to the vernier thruster R5D deselection, vernier thruster L5D showed signs of GHe ingestion while being fed by right OMS interconnect. When the RCS returned to straight feed, all thruster chamber pressure traces returned to normal. This indicated the source of GHe to be the crossfeed lines.

The most probable cause of gas in the crossfeed lines was a result of the Orbiter rollback procedure. When the Orbiter was rotated from the vertical to horizontal position while in the VAB, gas could move from the OMS tanks into the crossfeed lines. Once back at the pad, the OMS tanks were drained to less than 20 percent to remove any trapped gas. RCS tanks were not drained since the RCS was loaded full and trapped gas in the tanks was not a concern. Normal loadings, which fill the RCS and OMS tanks, sweep all gas from the crossfeed lines back into the OMS and RCS tanks. During STS-35 OMS reload, the crossfeeds were swept into the OMS tanks only. This results in the potential for a small quantity of gas to be trapped near the unswept RCS crossfeed valves. It should be noted that a possible but less likely cause of the failure is the GHe coming out of solution, due to saturated propellant, during each OMS blowdown cycle. The propellant would not normally be exposed to GHe for several months at the pad prior to launch, which increases the quantity for helium entering into solution. **CONCLUSION:** Low chamber pressure indications and the subsequent deselection of vernier thruster R5D were due to GHe ingestion by the thruster. The vernier thrusters are much more sensitive to small amounts of gas in the propellant than the primary thrusters and the chamber pressure traces seen during STS-35 were clearly symptomatic of gas ingestion. The GHe was most likely trapped in the crossfeed lines as a result of a procedure used in the loading of OMS propellant for this mission (result of work required to fix the MPS hydrogen leaks). It should be noted that this problem is not considered to be related to the primary RCS thruster low chamber pressures that were seen in OMS-to-RCS interconnect operations during the STS-38 mission. **CORRECTIVE_ACTION:** A new rollback procedure will be implemented. It will require that both OMS and RCS oxidizer tanks be drained after the Orbiter rotates to the horizontal. This would ensure that any gas in the crossfeed lines would be removed by sweeping into both OMS and RCS tanks during reload. The fuel side is not a concern due to system geometry. This procedure will be used in the STS-39 reload. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None. Normal loading of propellants should remove trapped gas in the crossfeed lines, and this failure can be cleared as was done during STS-35.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-35-V-21	MECH
None	GMT: Postlanding		SPR 41RF04	UA	Manager:
			IPR	PR PYR-2-11-0091	Engineer:

Title: The right hand aft separation hole plugger did not fully extend. (ORB)

Summary: DISCUSSION: The postflight inspection at Dryden Flight Research Center, revealed that the debris plunger in the EO-2 (LO2) separation fitting debris

container was caught by the frangible nut halves and failed to seat properly.

CONCLUSION: The LO2 (EO-2) separation hole plugger was prevented from seating by the debris which lodged in its path during separation. The hole plugger partially accomplished its purpose by preventing the majority of the debris from escaping into the umbilical cavity. CORRECTIVE_ACTION: Fly-as-is based on the following rationale: The interference with the hole plugger is a random event depending on debris rebound velocity attenuation and direction. The probability of a fragment preventing ET-door closure is considered highly remote. The vehicle is moving away from any escaping debris during the ET separation phase. Any escaped debris must abruptly change direction perpendicular to the original trajectory and then make its way to the clevis/rod to create a jam. A proposed design modification to improve Orbiter/ET separation debris containment is planned. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-35-V-22	MECH
None	GMT: Postlanding		SPR None	UA	Manager:
			IPR	PR PYR-2-11-0092	Engineer:

Title: Postflight Inspection Revealed Right Hand Stop Bolt was Bent. (ORB)

Summary: DISCUSSION: During the postflight inspection of STS-35, the forward Orbiter attachment stop bolt was found to be bent. The same type problem occurred on STS-34 (Reference Flight Problem Report No. STS-34-21) and on STS-38, although it was not formally documented. Following the STS-34 occurrence, tasks were established to research; landing site and ferry operations; and KSC ground processing operations. The following is a summary of these findings.

The results of the in-flight loads and stress analysis indicate that no known flight loads will cause this bending moment. Left and right side stop bolts are non-structural (not designed to carry any flight load, Criticality 3/3). The bent stop bolt position is outside of the flight envelope (roll angle is not large enough to cause contact). The required force would be detectable inflight through acceleration data. The moment about the monoball to bend the bolt is approximately 10,000 in-lb. The force required to produce a moment of 10,000 in-lb. is 900 lb. The analysis of the ET/Orbiter separation environment indicates that three different scenarios could possibly cause bending: uneven timing of the pyrotechnic firings; unbalanced chamber pressures within the Reaction Control System (RCS) thrusters (-Z burn); or thermal transients caused by shrinking of the tank during cryo-fill could result in an excess rolling moment at release. However, there are no anomalies in the Reaction Control System, films showed minimal rocking motion during pyro firing, and data from accelerometers and rate gyros showed less than normal thermal transient forces. During landing site and ferry flight operations the stop bolts are removed from the centering ring and inspected. Therefore, ferry flight operations cannot be the cause for stop bolt damage. The results of the KSC ground processing operations indicate that most operations do not have the capability to bend the bolt. However, mate and demate operations have the physical capability. The bolts are used to restrict side movement of bearing assembly during ET/Orbiter mate to limit damage to the Thermal Protection System. CONCLUSION:

The analysis indicates that the bolt is not being bent during flight. If the bolt is bent prior to flight, it poses no safety of flight issues. The Orbiter/tank mate/demating is the most probable cause. Without mate/demate monitoring, angular displacement could cause excessive loads. **CORRECTIVE_ACTION:** An RCN to the OMRSD is being developed to inspect and replace stop bolts as necessary. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None. The stop bolts are non-functional in flight. If the bolt is bent prior to or during flight, it poses no safety-of-flight issues.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: Prelaunch	Problem	FIAR	IFA STS-35-V-23
None	GMT: Prelaunch		SPR 35RF15	UA
			IPR	PR FCS-A0031
				Manager:
				Engineer:

Title: Pilot Seat Down Limit Switch Failure. (GFE)

Summary: DISCUSSION: Prior to launch, the astronaut support person (ASP) noted that the pilot seat would not drive downward from the full-up position. The ASP and a Lockheed engineer inspected the seat and found that the down position limit switch had not released when the seat was earlier driven upward from the full-down position. Since the down limit switch had not released, it inhibited power from reaching the seat motor when commanded to drive downward. The down limit switch was manually freed up and the ASP was able to drive the seat to the full-down position. The seat was then driven upwards, and a second attempt to drive the seat back down was again unsuccessful. Inspection showed that the down limit switch had again failed to release after moving off of the full-down position. The down limit switch was again manually freed up, and the seat was driven to full-down for launch. This condition was assessed and deemed acceptable for continuation of the launch activities since no downward motion of the seat was anticipated during ascent or an abort. Manual freeing of the limit switch, and a manual drive in-flight maintenance procedure were both available to the crew for moving the seat downward after ascent.

A similar problem occurred on the previous flight of this vehicle (anomaly STS-32-27) when the crew noted no down movement of the pilot seat during entry. Troubleshooting could not duplicate the problem or explicitly determine the cause of the problem. **CONCLUSION:** The failure of the STS-35 pilot seat to move downward was caused by the down limit switch not releasing from its down position. **CORRECTIVE_ACTION:** After OV-102 is moved to the Orbiter Processing Facility (OPF), mechanical checks of the down limit switch will be performed to better characterize how the switch is sticking. The down limit switch will then be removed and replaced. The removed limit switch will undergo failure analysis per the CAR listed below. The replaced limit switch will be verified per OMRSD retest requirements. If this problem should recur, electrically driven seat motion is still possible with manual manipulation of the stuck limit switch, and a manual method of driving the seat is available for use on-orbit. Procedural changes are being considered, pending the results of the seat mechanical checks, to back the seats off slightly from the fully extend positions during ground processing to help prevent future sticking of the limit switches. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>		<u>Subsystem</u>
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-35-V-24	STR, TPS
None	GMT: Postlanding		SPR 35RF16	UA	Manager:
			IPR None	PR	Engineer:

Title: Ice Formation on Rudder Speed Brake Panels. (ORB)

Summary: DISCUSSION: During the STS-35 postflight inspection of OV-102 at Dryden Flight Research Center, convoy personnel noted that a liquid was dripping from the right-hand rudder speed brake (RSB) panel splice point. Ice formation was observed between the right upper and lower RSB panels (Reference rudder speed brake part number MC621-0004-00XX) at the trailing edge and was dripping onto Space Shuttle Main Engine (SSME) 1. The substance was determined to be water that most likely came from the horizontal drain hole on the upper right-hand RSB panel (Reference letter TV-MSD-12 dated January 4, 1991).

The water should have drained out of the vertical drain hole on the upper right-hand RSB panel prior to launch. However, the possibility exists that the vertical drain hole may have been blocked. The drain holes were inspected in the Orbiter Processing Facility (OPF) per job card V31-15115 prior to STS-35 on February 21, 1990. Completion of that job card accomplishes the V31FEZ.010 OMRS. The OMRS is performed every flight and requires that a detailed external inspection be performed on the RSB to verify that the drain paths are free of obstruction. Three problem reports were generated because of tile filler bar covering the drain holes, one of which was the upper right-hand RSB vertical drain hole. The filler bar was trimmed away and the holes were verified to be free of obstructions. The source of the accumulated water is believed to be rain, humidity, and morning dew. The water was trapped between the upper and lower RSB on the launch pad and then turned to ice during flight. An accumulation of water between the upper and lower RSB is detectable if the RSB is open, but the presence of water or ice formations in this area are not detectable during a mission. The maximum amount of water that could be trapped was estimated to be 1.5 pints. After landing, clear ice was noted between the upper and lower RSB. The ice did not melt during entry. The expansion occurring when the trapped water freezes will not induce stresses in the structure because the ice is not in a constrained volume. Since the trailing edge surface is sealed per MA0106-303 (adhesive release agent, i.e., Braycoat grease or teflon spray), ice will not stick to the trailing edge surfaces and will not prevent opening of the rudder surfaces in a speed brake mode. The ice formation occurred away from the tiles installed on the rudder and was trapped by the seal and thermal barrier installation. The components containing the trapped water are Inconel material which is not susceptible to corrosion, or have corrosion protection. No mission effect results if water accumulation or ice formation occurs. The RSB will function with water or ice between the upper and lower RSB. The extra mass of 1.5 pounds because of the presence of ice had no effect on control surface performance. No previous problem of this kind has been reported. **CONCLUSION:** The presence of the ice in the RSB presented no mission hazard to the crew or vehicle. The source of the water and potential long term effects are being evaluated. **CORRECTIVE_ACTION:** No short term corrective action is required. The drain holes will continue to be inspected prior to each flight per OMRS. A long term recommendation may be made upon completion of the engineering evaluation. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.
